Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

Question number:	Answer	Additional guidance	Mark
(i)			(4) AO 1 2
	(measurement of) the mass of water (1)	accept volume / weight of water ignore amount	
	(measurement of) the temperature (rise/change) (1)	accept (take) thermometer reading	
	(measurement of) the energy supplied / from heater (1)	accept (take) reading of the joulemeter ignore 'change in thermal energy' (from equation)	
	detail of any of the above (1)	e.g. measure temp at the start and end or measure mass of empty cup or start and end readings on the meter	

Question Number:	Answer	Additional guidance	Mark
(ii)	any two improvements from:	both marks can be scored in one answer space	(2) AO 3 3b
		ignore repeating readings ignore increase voltage / power / energy ignore use of clamp to hold thermometer / heater	
	add lid /cover (1)		
	add lagging / insulation (1)	accept use better insulator or better insulated / thicker cup accept use calorimeter ignore use glass beaker unless cup is inside it ignore different type of cup	
	add a stirrer (1)		
	use a more sensitive thermometer (1)	accept use digital / electric thermometer / data logger	
	ensure heater fully submerged (1)		

Q2.

Question number	Answer	Additional guidance	Mark
(i)	two from: lagging (1) lid (1) repeat and average (1) surround heater/thermometer with oil (1)	 repeat with different time/temp rise/power Allow to reach maximum temperature at switch off.	(2)

Question number	Answer	Additional guidance	Mark
(ii)	temperature rise = 34 (°C) (1) substitution (1) $\frac{50 \times 300}{0.92 \times 34}$ evaluation (1) 480 (J/kg°C)	ecf temperature rise award full marks for correct answer without working	(3)

Q3.

Question number	Answer	Additional guidance	Mark
(i)	rearrangement (and substitution) (1) (c) $= \frac{1050}{0.058 \times 78}$ evaluation (1) 230 (J/kg °C)	$c = \frac{\Delta Q}{m \times \Delta\theta}$ award 1 mark if 78 seen accept 232(J/kg °C) award full marks for correct answer without working.	(2)

Question number	Answer	Additional guidance	Mark
(ii)	any two of the following reduce heat loss from water/insulate beaker/add cover (1) make the temperature rise larger/use a larger piece of copper/ use a smaller amount of water (1) (use)a stirrer (1) account for heat gained by glass beaker (1) transfer the hot copper faster (1) use a different heating method (1) measure the temperature of the boiling water (1)	ignore more accurate measurements e.g. thermometer, balance etc. ignore taking repeats start with colder water	(2)

Q4.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Fibre glass • has lower R-value • similar R-value (to polystyrene) • derived from sand so plentiful / cheap • non-flammable • dangerous to install • concludes / uses other arguments to say that it is a suitable or unsuitable material Polystyrene • high(est) R-value so suitable on that score • (but) involves petroleum / oil extraction so (could be) environmentally damaging • melting / flammable / fire hazard / release of toxic fumes • concludes / uses other arguments to say that it is a suitable or unsuitable material	**(6)** **AO2, AO3**

AO targeting: 3 marks AO2 strand 1 and 3 marks AO3 strand 1a and 1b

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1–2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3–4	• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance at least two pieces of information from the table used OR one piece of information on the table and makes a simple choice	Possible candidate responses R is 4.0 for polystyrene + fibreglass is not flammable OR we should use fibreglass
Level 2	3–4	Additional guidance compares at least two properties OR compares one property and gives a conclusion about suitability uses information from the two materials used AND makes some comparison(s) / concludes logically about suitability	Possible candidate responses fibreglass has a lower R-value and is not flammable, but polystyrene is OR fibreglass is not flammable, but polystyrene is, so fibreglass better
Level 3	5–6	Additional guidance compares at least two properties AND gives a conclusion (both materials involved, allow one to be discussed in greater detail than the other) WITH logical connections between elements argued from the table.	Possible candidate responses fibreglass and polystyrene have similar R-values. Fibreglass is not flammable, but polystyrene is, so fibreglass is better